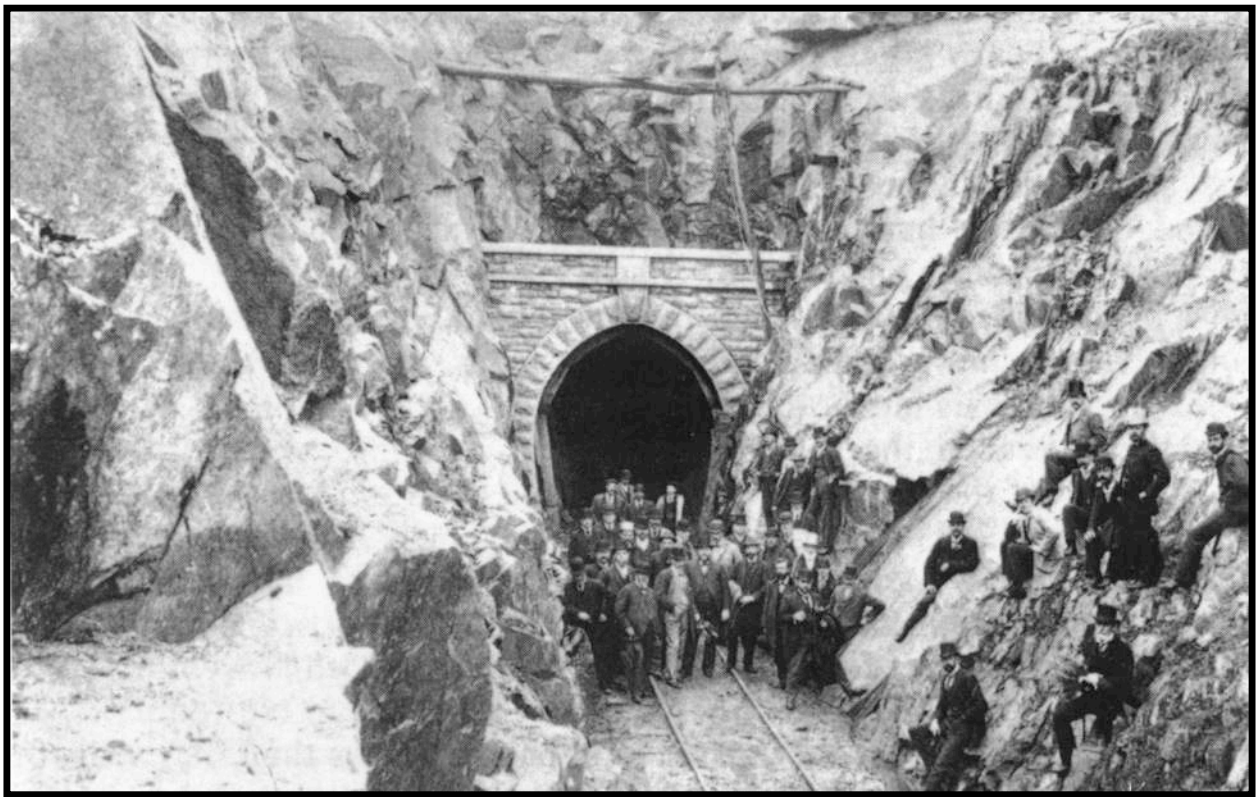
ENGINEERS AUSTRALIA
Western Australia Division

NOMINATION OF

EASTERN RAILWAY DEVIATION

FOR
ENGINEERING HERITAGE RECOGNITION



PREPARED BY ENGINEERING HERITAGE WESTERN AUSTRALIA
ENGINEERS AUSTRALIA
WESTERN AUSTRALIA DIVISION

OCTOBER 2014

CONTENTS

Photographs: Except where indicated, all photographs in this document are by courtesy of 'The Mundaring and Hills Historical Society'

Cover page photo: On the occasion of the opening of the Swan View Tunnel, at the western portal, 1896.

1. INTRODUCTION

The construction of state railways in Western Australia during the late 1800's opened up large areas for settlement that previously were uninhabitable due to their isolation and the difficulties settlers encountered either obtaining supplies or getting their produce to markets.

In 1881, the first stage of what became known as the Eastern Railway was completed. The line ran between Fremantle (on the coast) and Guildford (east of Perth). Construction of Stage 2, which extended the line to Childow's Well (now Chidlow), was completed in 1884. Stage 3, which stretched from Chidlow's Well to York, was completed in 1885. The discovery of gold at Kalgoorlie in 1887 provided impetus to extend the rail line further east, reaching Kalgoorlie and the associated gold fields in 1897. An overview of the railway can be seen in Figure 1.

A section of Stage 2, travelling down the Darling Range escarpment east of Midland Junction (now Midland), included a number of unfavourable curves and steep grades, which became a problem as loads became heavier. One section in particular, between Midland Junction and Lion Mill (now Mount Helena), was of great concern. A segment of the track near Boya, which had a steep 1:38 gradient coupled with a sharp curve, became known to railway employees as 'Cape Horn'. The track became evermore dangerous as heavier cargos from the expanding eastern agricultural areas were sent to Perth and the port of Fremantle, leading to some serious derailments.

The 'Eastern Railway Deviation' (originally known as the 'Mahogany Creek Deviation'), opened in 1896, was a rail deviation that bypassed this difficult section of line. The 12 mile (19 km) deviation ran through an undeveloped section of the Darling Range escarpment, following a creek-line which was then thought to be the Mahogany Creek feeding down from higher up in the Range. In fact, the creek-line belongs to the Jane Brook. The deviation allowed gradients to be kept below 1:50 and eliminated sharp curves. However, it required a granite ridge to be traversed. This was achieved by the construction of a 1089 ft (332 m) long tunnel through the ridge, known as the Swan View Tunnel, using dynamite and entirely manual labour.

The Eastern Railway Deviation was a major technical feat for the time, particularly in the construction of the tunnel. Moreover, the line enabled major commercial and social development by opening up the Jane Brook valley for timber-cutting, quarrying and farming, the development of associated communities and towns, and not the least, the preservation of a major public natural resource in the John Forrest National Park.

This nomination pertains to the whole Eastern Railway Deviation (Bellevue to Mt Helena), but focuses on the section contained within the John Forrest National Park, with the engineering of the tunnel as its centrepiece.

2. STATEMENT OF SIGNIFICANCE

The Eastern Railway Deviation has engineering heritage significance for the following reasons:

- The construction of Eastern Railway Deviation was a major engineering project that saw vast amounts of rubble moved to construct embankments, together with intensive blasting and digging which created the first rail tunnel for Western Australia. All of this was achieved by using only picks and shovels, dynamite and horsepower.

- Until the early 21st century, the Swan View Tunnel was the only railway tunnel constructed in Western Australia. Cut through solid granite over a distance of 332 m, it remains the only rail tunnel of its type in Western Australia, the more recent tunnels being constructed by trench-and-cover techniques in sandy soils within the Perth CBD.

- The construction of the Swan View Tunnel was a major technical feat for the time. The precision with which both ends of the 332 m tunnel met during construction serves to illustrate the technical achievements of both the surveyors and engineers of the day who laboured under extreme difficulties.

- The Deviation was part of the major eastern link for all rail transport in Western Australia from 1896 until 1966.

- The passage of the Deviation through the scenic Jane Brook valley led to the establishment of the John Forrest National Park, the first national park in Western Australia.

- The construction of the Deviation saw a number of settlements develop along its route, which still exist today, and was the major service link for these settlements until the Great Eastern Highway took precedence in the late 1950s.

- The access provided by the Deviation enabled the establishment of significant quarrying, timber cutting and orchard industries.

- The route has close associations with C.Y. O'Connor, the Engineer-in-Chief for the Public Works Department and responsible also for the design of Fremantle Harbour and the Goldfields Water supply.

- The route has been a major recreational heritage trail since 1988.

- The remaining buried wooden trestle bridge, which is in its original form beneath an embankment, has the potential the reveal construction techniques and material culture dating from the first quarter of the twentieth century.

3. LOCATION

The locations of the towns/cities referred to in this nomination, and the route of the eastern railway, are shown in Figure 1. A detail of the John Forrest National Park segment can be seen in Figure 2.

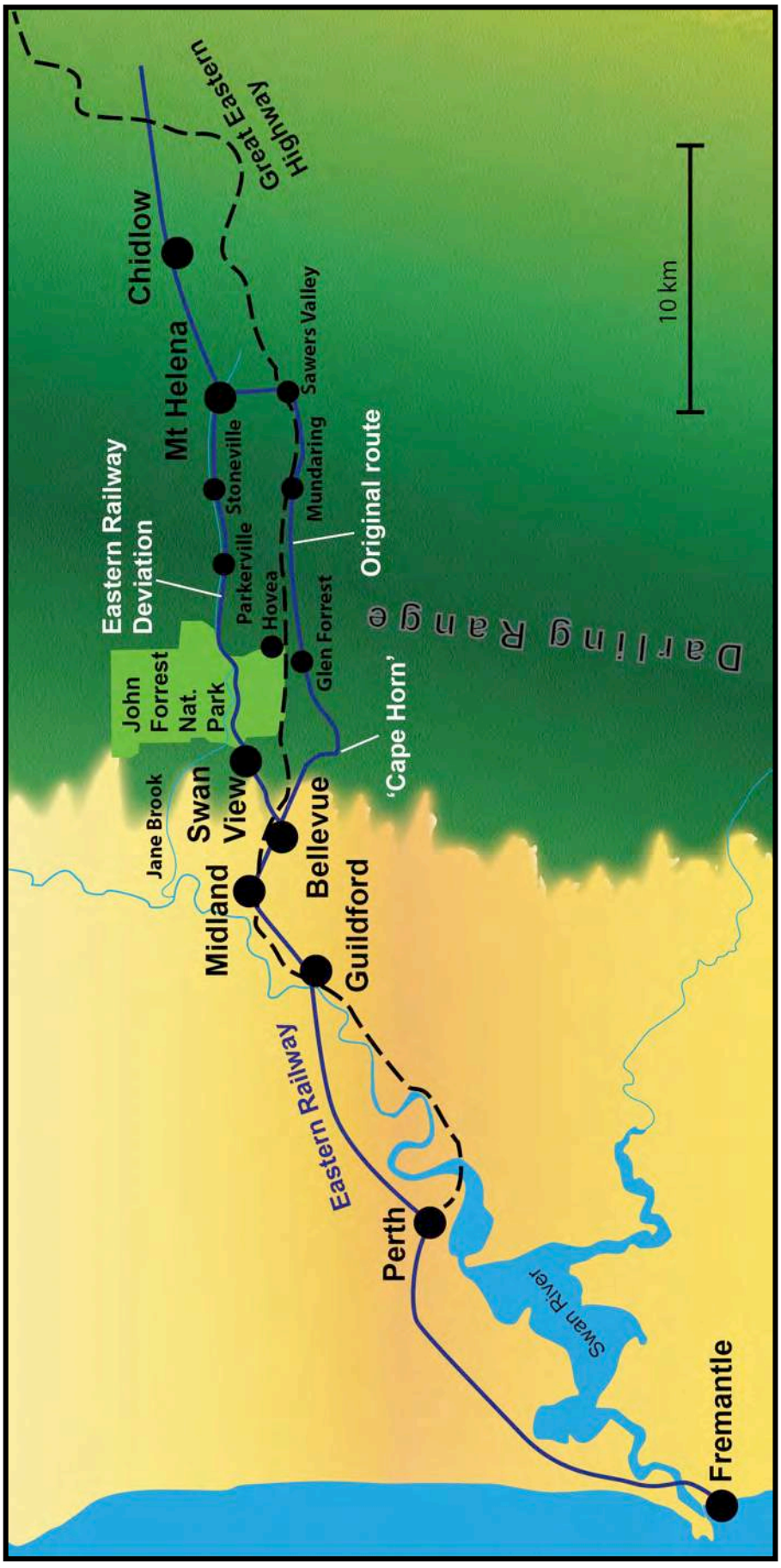


Figure 1. *Overall location map showing the route of the eastern railway. (Drawing: Mark Bush)*

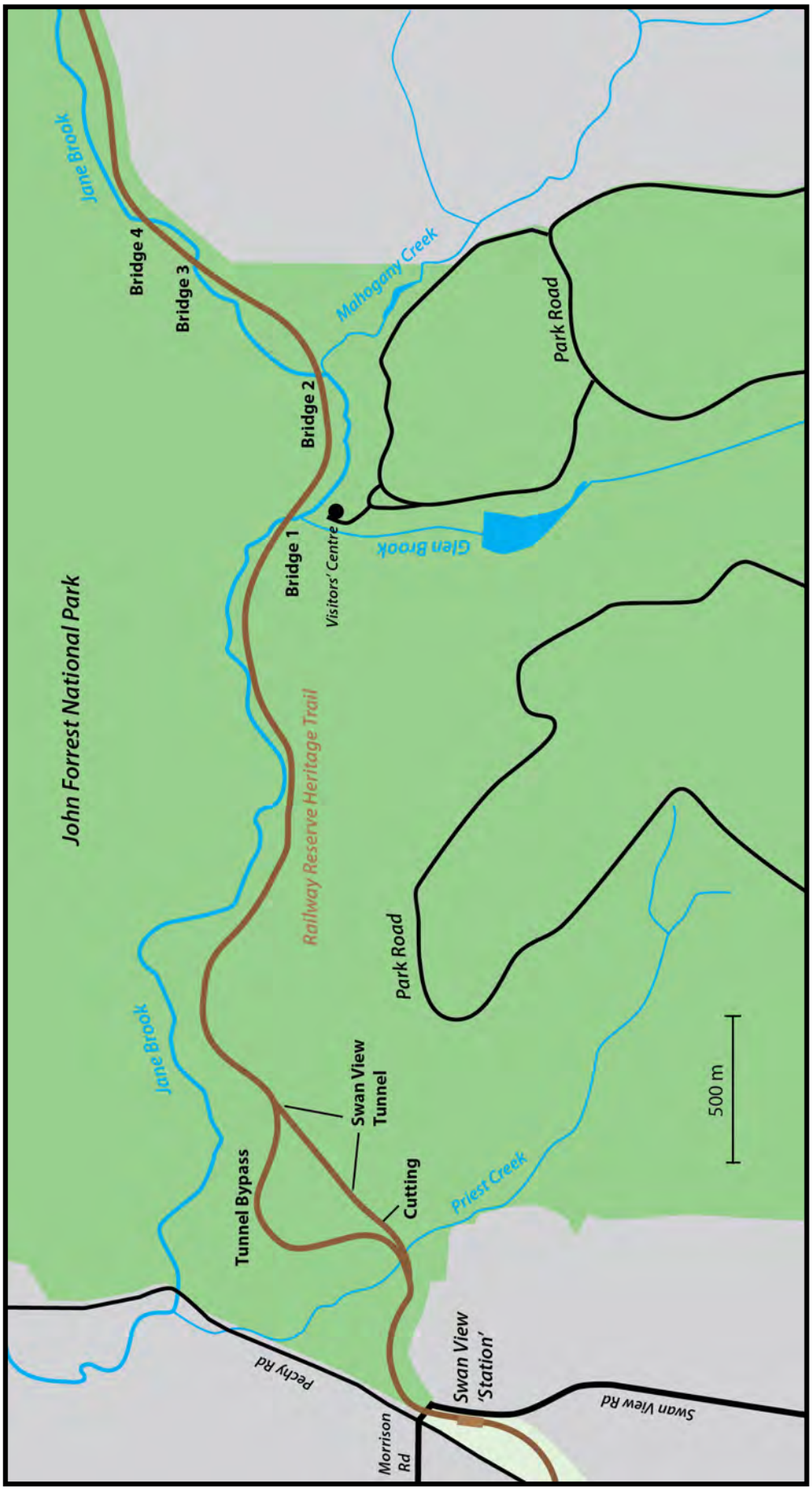


Figure 2. The route of the railway through the John Forrest National Park. (Drawing: Mark Bush)

4. HERITAGE RECOGNITION NOMINATION FORM

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of Work: *Eastern Railway Deviation*

Location, including address and map grid reference:

This nomination refers to the *Eastern Railway Deviation* extending from Bellevue to Mt Helena via the John Forrest National Park. The National Park segment includes the Swan View Tunnel and four notable bridges (see Figure 2).

Coordinates:

Bellevue	31^{0} 53' 48" S, 116^{0} 01' 54" E
Mt Helena	31^{0} 52' 41" S, 116^{0} 12' 37" E

John Forrest National Park Visitors' Center	31^{0} 53' 02" S, 116^{0} 05' 36" E
Western Trail entry to Park (Swan View)	31^{0} 53' 07" S, 116^{0} 03' 39" E
Eastern Trail entry to Park	31^{0} 52' 32" S, 116^{0} 06' 49" E
Swan View Tunnel (western portal)	31^{0} 53' 03" S, 116^{0} 04' 05" E
Bridge 1	31^{0} 52' 56" S, 116^{0} 05' 32" E
Bridge 2	31^{0} 52' 59" S, 116^{0} 05' 51" E
Bridge 3	31^{0} 52' 44" S, 116^{0} 06' 05" E
Bridge 4	31^{0} 52' 40" S, 116^{0} 06' 09" E

Owner: Department of Parks and Wildlife, Government of Western Australia, Locked Bag 104, Bentley Delivery Centre, WA 6983.

The Owner has been advised of this nomination and a letter of agreement is included.

Access to site: The entire length of the railway route is now a wide, well maintained heritage trail traversable on foot or bicycle. Access by approved vehicles is also possible. All sites mentioned in the proposal are accessible from the trail. The John Forrest National Park Visitors' Centre can be reached by sealed road from the Great Eastern Highway at Glen Forrest.

Nominating Body: Engineering Heritage Western Australia, Engineers Australia, Western Australia Division.

Mark Bush

Professor Mark Bush, Chair EHWA
Date: xx October, 2014

5. OWNER'S LETTER OF AGREEMENT

Government of **Western Australia**
Department of **Parks and Wildlife**

Your ref:
Our ref: CEO498/14
Enquiries: Benson Todd
Phone: 9290 6100
Email: benson.todd@dpaw.wa.gov.au

Professor Mark Bush
Chair
Engineering Heritage Western Australia
712 Murray Street
WEST PERTH WA 6005

Dear Professor Bush

ENGINEERING HERITAGE RECOGNITION OF THE MAHOGANY CREEK (RAIL) DIVERSION – JOHN FORREST NATIONAL PARK

Thank you for your letter dated 14 April 2014 regarding the proposed nomination of the Mahogany Creek Rail Diversion for engineering heritage recognition by Engineering Heritage Australia.

The Department of Parks and Wildlife is pleased to support this initiative and if the nomination is successful would support the installation of an interpretive panel and assist with a dedication ceremony.

Works are currently underway to restore the railway bridges in John Forrest National Park, with the first bridge expected to be completed later this year. I hope that recognition of the technical, historical and community importance of the Mahogany Creek Rail Diversion coupled with the restoration of the railway bridges will further enhance the value of the heritage trail in John Forrest National Park.

I wish you all the best with the nomination and recommend that should you wish to discuss any of the operational aspects of this proposal in more detail that you contact the department's Perth Hills District Manager, Mr Benson Todd on 9290 6100 or by email at benson.todd@dpaw.wa.gov.au.

Yours sincerely

Jim Sharp
DIRECTOR GENERAL

1 May 2014

Office of the Director General
Locked Bag 104, Bentley Delivery Centre, Western Australia, 6983
Phone: (08) 9219 9000 Fax: 9219 9967
www.dpaw.wa.gov.au

6. HISTORICAL SUMMARY

The wide open spaces and long distances faced by residents of the fledgling Swan River Colony (Western Australia), established in 1829, led to reliance on railways in the 19th century as the most reliable and efficient means of facing the challenges of transport. By the end of the century a remarkably complex network of rail lines existed in Western Australia, communicating many hundreds of kilometres to the south, north and east of Perth based on a maze of rail spur lines radiating off major rail line backbones [1]. The 'Eastern Railway' was one of these major rail routes, heading east from Perth through the railway node of Midland Junction, and reaching the Kalgoorlie goldfields in 1897. This line was later extended to form a rail link between the east and west coasts of the continent.

Shortly after the completion of the first stage of the Eastern Railway in 1881 (Fremantle to Guildford) loan funds were approved by the Legislative Assembly for the construction of Stage 2, which extended the line to Childow's Well (Childlow), traversing the Darling Range escarpment by travelling a route roughly parallel to the existing roadway at Greenmount Hill [2] (see Figure 1). Initial surveys around Greenmount Hill indicated that the gradients would be rather steep and some of the curves less than ideal. Nonetheless, for purposes of expediency, tenders were called and the contract let to J.W. Wright in December 1881. Work was completed in 1884 [3]. Stage 3, which stretched from Chidlow's Well to York was constructed by Edward Keane and completed in 1885 [2]. The extension of the rail network to the southern port of Albany in 1889, branching off the Eastern Railway at the town of Beverley, opened up the great Southern district and put extra load on the eastern route. By the last decade of the 19th century the growing agricultural and mineral production of the colony's outlying districts placed pressure on the rail infrastructure. The system was now inefficient and running at a loss.

Figure 3. A train derailment on the Eastern Railway at Boya, 1896, killing one man and eight horses.

Shortly after C.Y. O'Connor's appointment as Western Australia's Engineer-in-Chief in 1891, he undertook to improve the efficiency of the rail system. Western Australia had only just been granted responsible government, under the leadership of John Forrest. The recent discovery of gold provided the government coffers with much needed revenue which could be used to upgrade parts of the railway system. O'Connor's predecessor, J. Arthur Wright, had written a report in August 1885 on the Eastern Railway, commenting that for a small additional outlay to carry out trial surveys to choose the most effective route and greater expenditure on earthworks, the operating expenses on the line would have been greatly reduced. O'Connor agreed with Wright's assessment of the problem on the Eastern Railway, and he set about trying to make Western Australia's rail system profitable [2].

Wright's report had noted the rather unfavourable curves and steep grades on Section 2 of the Eastern Railway. As traffic on the route became increasingly heavier these defects began to take their toll. One section in particular, between Midland and Lion Mill (Mount Helena), was of great concern. Problems were generally encountered on the downward trip, in particular at a point near Boya which had a steep 1:38 gradient coupled with a sharp curve. This section of the track became known to railway employees as 'Cape Horn', the site of some significant derailments [2]. This limited speeds and loads, making the line particularly inefficient.

In October 1891, O'Connor seconded railway engineer and surveyor John Muir from Victoria to find a more favourable route up the Darling Range escarpment. Muir surveyed three routes to the north of the existing line: through the Swan River valley, the Helena valley and the Mahogany Creek valley. Muir recommended the Mahogany Creek route as the most cost efficient [2]. This watercourse was incorrectly identified at the time as the Mahogany Creek. In fact, the Mahogany Creek is a tributary to Jane Brook, joining the Brook at a higher elevation in the range (see Figure 2).

He estimated construction costs at £86,000. Funding was approved and tenders called in October 1893. The South Australian firm of Smeaton and Hedges was successful with a tender of £47,8608 [4]. This quote was for the construction of a tunnel, earth works, ditches, cuttings, embankments, protective facings to embankments, six bridges and culverts; the government supplied the rails [5].

The contract also stipulated that excavation work was to be carried out 24 hours per day, except on Sundays. The total length of the contract was 12 miles, 60 chains (19 km). The gradient was to be 1 in 50 with the minimum radius of curves to be 12 chains (240 m). The route followed the contours of Blackboy Hill, the Darling Range and the Jane Brook (or Mahogany Creek as it was mistakenly called), in a series of curves. Unfortunately this route also featured a granite ridge that acted as a natural barrier. O'Connor's solution to this problem was to construct a tunnel of length 1,089 feet (332 m) through the ridge [4]. All of the work was carried out using picks, shovels and blasting, with the accumulated spoil carted away by horses. Excavation work on the tunnel proceeded from both ends and they met perfectly on 18 April, 1895.

Figure 4. The main construction camp, 1894-95

Figure 5. Digging a cutting, c. 1894

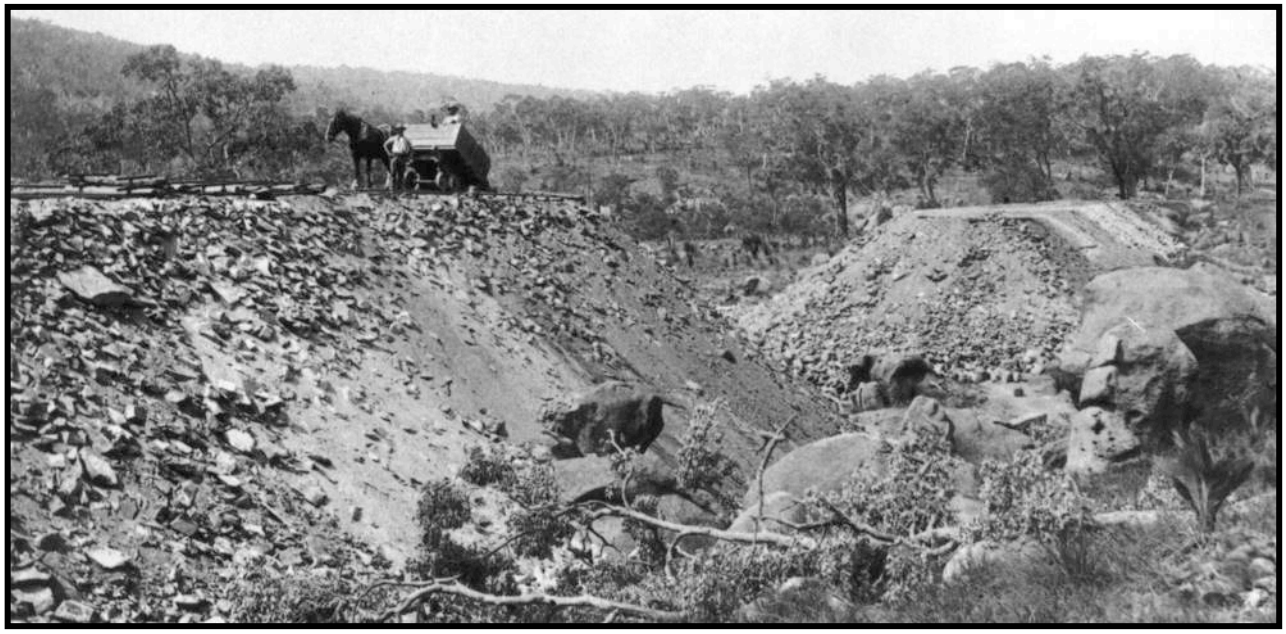


Figure 6. Construction of an embankment, c. 1894

A report on the progress of the works was presented to Parliament during 1895 [6]. It noted:

> *… [The] works are exceptionally heavy for this Colony, and comprise a succession of deep cuttings, mostly through rock (hard diorite), and of high banks across gullies and ravines. Not far from the centre of the length is a tunnel 16.5 chains long, which has been pierced through the solid rock (chiefly granite); the approach cuttings to this are of considerable magnitude. The heading was broken through on 18 April, and the lines and levels from the two ends were found to come in exactly. Owing to the somewhat treacherous nature of the rock formations, as experienced in the cuttings and in the tunnel itself, it has been decided to give effect to the provision made against such possibility in the specification, and line the tunnel throughout. The side walls are being built of masonry, and the arches will be turned in brick. This tunnel is the only one, so far, on the railways of the Colony.*

It is interesting to note the comment in the last sentence, which was the situation in 1895. In fact, this statement remained true until several trench-and-cover tunnels were constructed on the Perth city network in the CBD after the year 2000. The precision with which both ends of the tunnel met during construction serves to illustrate the technical achievements of both the surveyors and engineers of the day, who laboured under extreme difficulties.

The line was completed by 22 February, 1896, and trains commenced immediate operation. The route was officially opened on 1 July, 1896 [2].

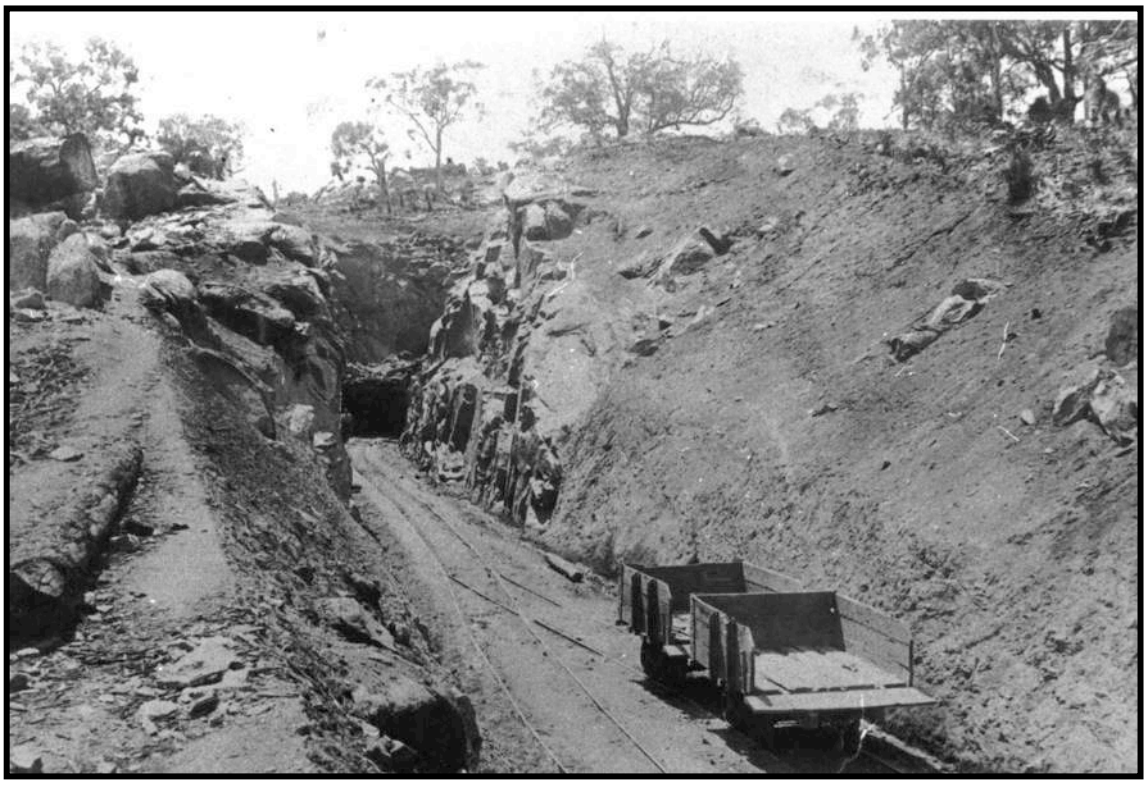


Figure 7. Construction of the tunnel, western entrance, c. 1894.

The Public Works Department report of 1895 [6] also described the bridges:

> *…… the largest is that over the stream at 28 miles 49 chains, consisting of 25 spans of 15 ft., and one span of 40 ft. The abutments and piers of one bridge are of masonry, and of the others of driven piles, or trestles on concrete foundations. The superstructures are jarrah, except the lower cords of the 40 ft. span, which are karri.*

Figure 8. One of the smaller wooden trestle bridges, replaced by steel deck bridges on concrete abutments in the 1920s.

Figure 9. The longest (126 m) of the original 4 bridges in the John Forrest National Park. See Fig. 2 - Bridge 2. This bridge was buried within an earth embankment during the 1920s and remains in that state today.

O'Connor had estimated that the improvements to the line would save the government approximately £19,000 per annum. This was assuming that traffic on the route would increase by twenty-five percent. Returns in the years to follow were to vindicate the expense of the deviation [2].

The completion of the deviation led to opening up of land along the Jane Brook valley to settlement and industries such as quarrying and timber cutting. Orchards were soon established in the area and small settlements sprang up along the route, such as Hovea, Parkerville and Stoneville. Industries made full use of the nearby rail transport to move goods to Perth [3]. Additionally, the picturesque qualities of the Jane Brook valley soon came to be appreciated and in 1898 a reserve was set aside for public use. Through the efforts of Premier John Forrest, the area became Western Australia's first National park in 1901; The Greenmount National Park. The Park was renamed the John Forrest National Park in 1947. A stopping point for picnickers was initially provided near Hovea until a station was installed further to the west in 1936. This station was provided specifically to cater to day-trippers.

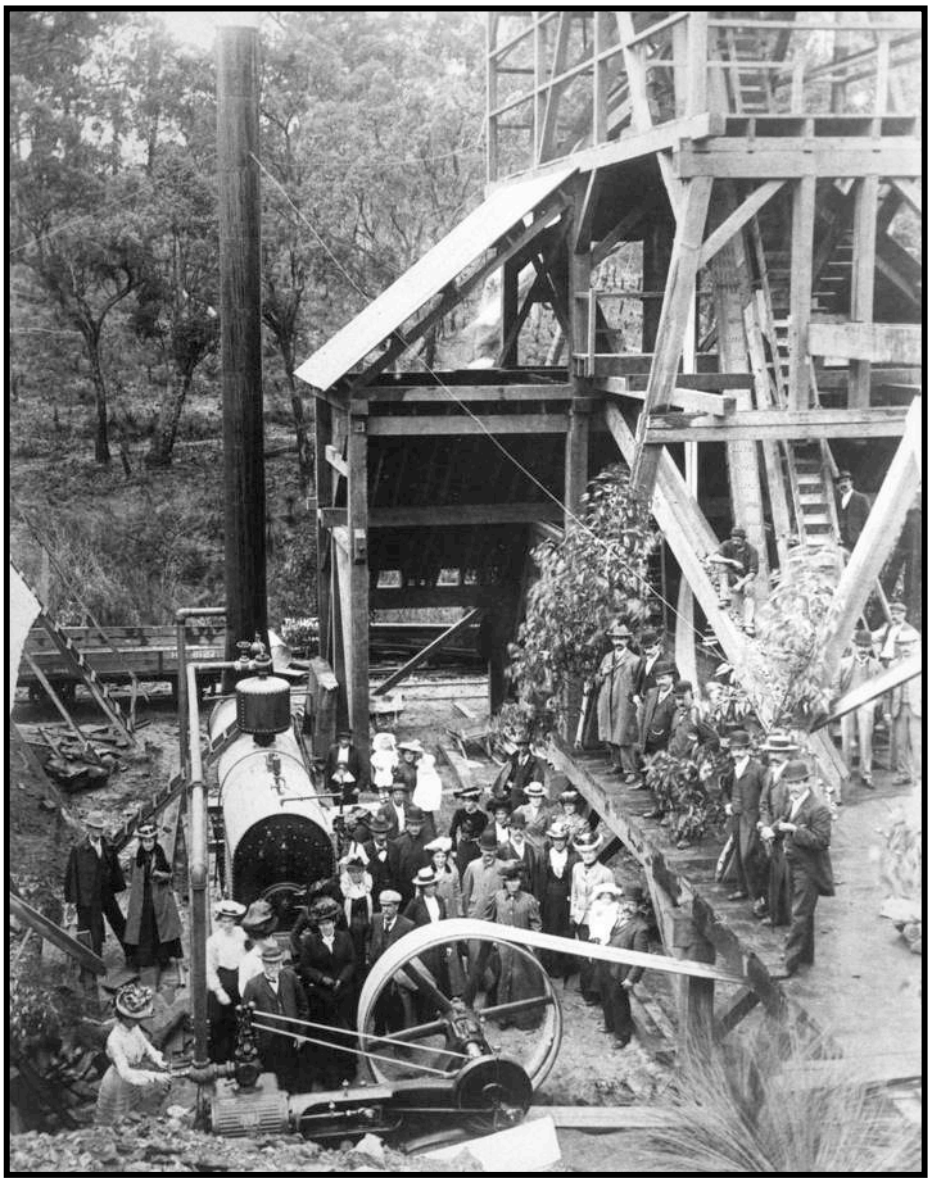


Figure 10. Opening of the Parkerville Quarry, 1902, one of the industries enabled by the railway. (Photo: State Library of WA)

Although a spectacular technical achievement, the tunnel was not very well ventilated for its length. The line traverses up-hill through the tunnel to the east, leading to danger from noxious fumes produced by east-bound trains travelling slowly under full steam up the grade. This problem became more critical as engine capacities and loads grew with further expansion of the Eastern Railway. Drivers or firemen were frequently overcome by the noxious fumes and heat [2]. In December 1903, driver John Ross fainted and fell off the train while it was heading east. The fireman, C. Marsden didn't notice that the driver was missing until he had reached the other end of the tunnel. Fortunately, the driver had remained unharmed after his fall from the train [7]. Nearly a year later, the *Swan Express* reported that the tunnel was still causing trouble and cynically noted that probably nothing would be done until someone died [8].

Experiments to reduce these effects were trialled by the Railways Department: wet sponges, wet hessian bags and even an air tube extending into the cabin from the front of the engine. The men would often lie on the floor of their cab with a hessian bag placed over their heads [9]. Finally, in 1914, after a serious accident occurred in the

tunnel, a deputation of engine drivers and firemen approached the commissioner for railways, Mr J. T. Short. Mr Short was sympathetic, and 'promised to ameliorate the conditions until such times as an open cut or deviation' could be constructed to deal with the problem [10]. To help alleviate the problem, a 'banker' engine was attached to the rear of the train to assist with the push through the tunnel [3].

Nothing more substantial was done. Then, in November 1942, the worst fears of the men who travelled through the tunnel were realised. Two locomotives were pulling a train through the tunnel when the drivers and firemen in both locomotives were overcome by the heat and fumes. Conditions on the track led the train to stall and it rapidly began its descent back down the hill towards Swan View, where the alert station-master routed the train onto a spur line. The driver in the second locomotive, Tom Beer, was killed and debris from the wrecked train was spread across both tracks, blocking traffic on the line for some time [4].

A government enquiry into the incident found that the unconscious driver's blood was saturated with carbon monoxide. It was readily acknowledged that the tunnel required ventilation but how this was to be effectively achieved during war-time conditions became the main stumbling block [11]. An alternative solution was to create a surface deviation of the line around the ridge, made possible by the availability of modern earth-moving equipment. A suitable route for a deviation was located to the north of the tunnel in April 1943 (Figure 2). The cost of constructing the deviation was estimated at £130,000. Tenders were called for the construction of the deviation in May 1944 and the new deviation was opened for traffic in November 1945 [11]. West-bound trains continued to use the tunnel while east-bound trains used the new deviation.

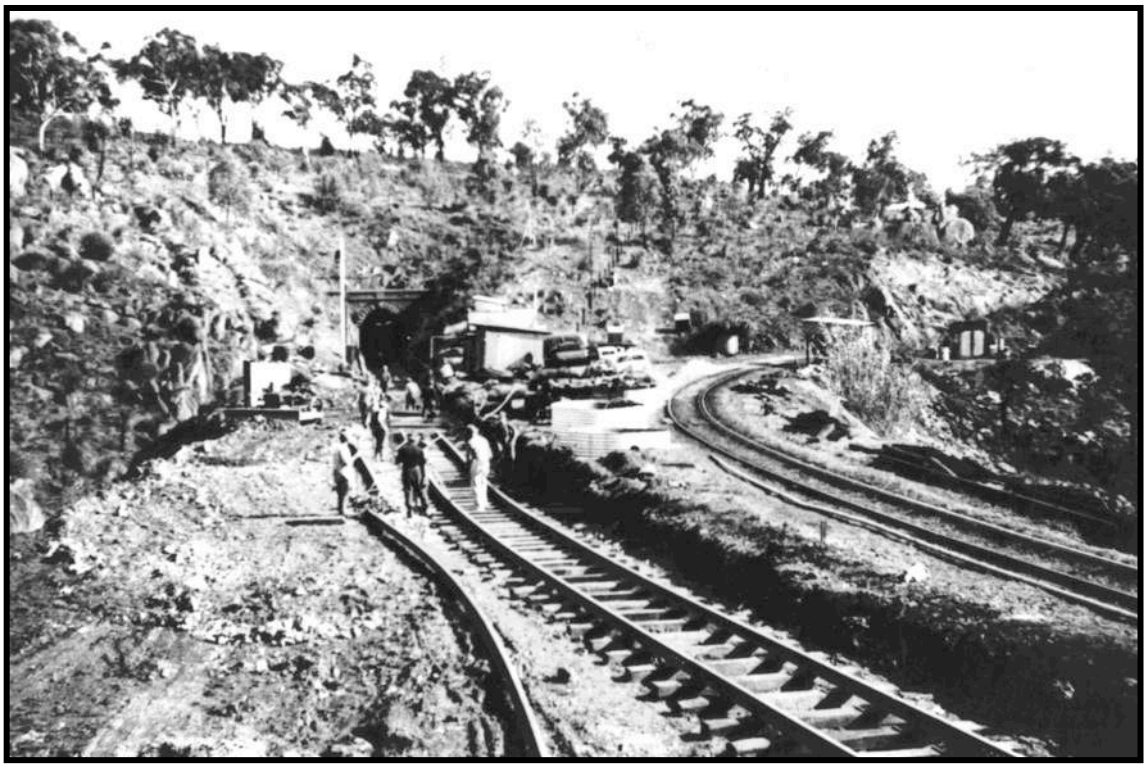


Figure 11. A view of the eastern tunnel portal after 1945, showing the tunnel bypass route to the right.

By the 1920s, due to age and the increase in the size of locomotives, the wooden bridges on the Deviation had become somewhat unstable and in 1928, three of the bridges within the John Forrest National Park (known at this time as Greenmount National Park), were replaced with riveted steel girder structures (Bridges 1, 3 and 4 - Fig. 2). They were manufactured at the Midland Junction Workshops. The remaining bridge (Bridge 2 on Fig. 2), which at 126 metres was the longest on the line, was completely buried beneath an earth embankment. Concrete culverts were placed underneath the old bridge to allow the Jane Brook to flow through. The bridge remains today 'entombed' in layers of soil and gravel within the embankment [3].

During the 1950s, bus travel between Midland and the various settlements in the 'hills' gradually became more popular and rail patronage began to decline. In 1958, the original Eastern Railway route between Bellevue and Mundaring closed [3].

In 1961, the Western Australian Government signed the Railway Standardisation Agreement with the Federal Government. This agreement provided for a standard gauge link between Kwinana, Fremantle and Kalgoorlie, which connected to the Commonwealth east - west rail link. Work on the new link commenced in November 1962. The new route followed the Avon Valley, one of the routes (Swan Valley) initially surveyed by John Muir in 1891. The route was opened to traffic on 15 February 1966. The Western Australian section of the standard gauge railway was recognised by an Engineering Heritage National Landmark award in March 2012 [12].

The opening of this new route led to the closure of the Eastern Railway Deviation [4].

In 1978, the Public Works Department decided that the tunnel could serve as a baseline facility for calibrating survey instruments. The ends of the tunnel were bricked in and metal doors fitted, to assist in providing a stable environment. The track was lifted and seven concrete pillars were placed in a line down the centre of the tunnel.

Along the remainder of the route, the rails were lifted and the line was abandoned. In 1988, the route was revitalised when it became part of the Heritage Trails Network established by the Western Australian Heritage Commission as part of a Commonwealth Bicentennial Project [13]. The tunnel was re-opened and the bricked up portals and concrete survey pillars removed. Today, the former Mahogany Creek Deviation forms part of the Railway Reserve Heritage Trail.

The settlements that sprang up along the line continue today as separate entities within the Shire of Mundaring. The unusual nature of this pattern of settlement led to the establishment of a special clause within the Shire's Town Planning Scheme No. 3 which recognised that rural buffer zones should be kept between the settlements to maintain the individual character of each settlement.

7. BASIC DATA

Item Name	Eastern Railway Deviation
Location	Railway Reserve Heritage Trail, Bellevue to Mt Helena via John Forrest National Park.
Address	Focal point on the Trail: John Forrest National Park Visitors' Centre, Park Road, Glen Forrest.
Suburb	Bellevue, Swan View, Hovea, Parkerville, Stoneville, Mt Helena.
State	Western Australia
Local Govt. Area	Department of Parks and Wildlife, Shires of Swan and Mundaring.
Owner	Department of Parks and Wildlife, Government of Western Australia (section of the trail within the John Forrest National Park, being the focus of this nomination.)
Current Use	Railway Reserve Heritage Trail
Designer	Public Works Department, Western Australia
Constructor	Smeaton and Hedges (South Australia) and WA Government Railway workshops
Year Started	1894
Year Completed	1896
Modifications and Dates	See sections, "Historical Summary and "Physical Description and Current Condition"
Historical Notes	See section "Historical Summary"
Heritage Listings	Swan View Tunnel and associated bridges: Permanent Entry on the WA State Register of Heritage Places, June 2002, Data base numbers 2660 and 2663. National Trust of Australia, Classified, 12 June, 1989.

8. PHYSICAL DESCRIPTION AND CURRENT CONDITION

General

The rail tracks were removed in the 1970s. The route of the Eastern Railway Deviation is now part of a heritage trail ('The Railway Reserve Heritage Trail') traversed by thousands of visitors each year on foot, bicycle or horseback (outside the National Park). The trail is maintained by the Department of Parks and Wildlife (the section within John Forrest National Park, including the tunnel and remaining bridges), the Shire of Swan (Bellevue to Swan View) and the Shire of Mundaring (eastern Park boundary to Mt Helena). The bed of the trail is composed of clay and loose pea gravel with scatterings of blue metal, evidence of its former use as a railway line.

The Swan View Tunnel is nestled within the park and blends well with the natural environment. The dark cavern within, created by the vault, lends an aura of mystery for travellers using the heritage trail, either following the tunnel bypass route or venturing through the tunnel itself.

A reconstruction of the Swan View railway station is located on the trail adjacent to Swan View Rd, near the intersection with Morrison Rd, Swan View. Although not the original station, it is a close replica of the original.

Figure 12. Reconstructed Swan View Railway Station, present day. (Photo: Mark Bush)

(Temporary photo used above. New photo to be taken)

Swan View Tunnel

The impressive western portal of the Swan View Tunnel is located approximately 500 m from the western boundary of the Park (Pechey Rd x Morrison Rd). The tunnel has been cut through granite; the western portal lies at the end of a long, deep cutting that displays shock fracture patterns, the evidence of dynamite blasting. The tunnel rises gently to the east for 332 m.

Both the western and eastern portals are constructed from ashlar stones (granite), with dressed margins, laid randomly. The rectangular, dressed stones above the keystones of both portals bear the date '1895'. A low, capped parapet rises above the archway and

hides a concrete dome in the western portal, which appears to seal the front portion of the tunnel's vault before it disappears into the granite hillside.

Figure 13. Western tunnel portal, present day. The minute 'light at the end of the tunnel' highlights the length of the tunnel (Photo: Fiona Bush)

In the interior, the lower sections of the tunnel are lined with roughly dressed, randomly laid stone which extends to a height of 1.7 metres. Above the stonework the tunnel is lined with bricks laid in stretcher bond. The bricks meet at a point in the centre forming an arched, rather than a curved vault. The floor of the tunnel consists of a thick layer of blue metal. Drainage pipes run down the length of the tunnel on the southern side. These pipes do not appear to be connected to any sump or exit point.

Shallow safety recesses have been built into both sides of the tunnel at approximately 21 metre intervals. These recesses alternate from side to side and are 1.8 metres wide, 2.15 metres high and .75 metres deep. The third recess from the western end (68.2 metres from the western end), has been fitted with a metal cupboard.

The tunnel appears to be in good condition and no evidence of any extensive cracking is evident. The ceiling is covered in a heavy layer of soot.

Figure 14. Tunnel interior, present day (Photo: Fiona Bush)

The Bridges

Of the original 6 bridges built as part of the tender for the Eastern Railway Deviation, four were located within the John Forrest National Park at crossings over the Jane Brook. Evidence of these four bridges exists today. Three are still in use. Nothing remains of the two bridges that were located outside the Park.

All three operational bridges share a similar design, consisting of a pair of parallel spans, each span being 2.5 m wide. The condition of the bridges has been deteriorating over recent years, however The Department of Parks and Wildlife undertook a major refurbishment program in 2013 to stabilize and repair the bridges. The work is due to be completed in late October, 2014. One span in each pair has been refurbished using concrete 'timber-look' sleepers and a new handrail installed to allow continued use of the bridges by the public on the trail. The second span on each bridge has been stabilised in its original 1920's form to highlight this historical construction. Timber sleepers salvaged from all three bridges have been used to refurbish the decking on Bridge 1.

Bridge 1, approximately 2 km eastward from the tunnel (see Fig. 2), is the largest operational bridge. It is situated on the Jane Brook near the point where Glen Brook enters. The bridge is close to the John Forrest National Park Visitors' Centre. This is

one of the main picnic areas in the Park. The bridge consists of a pair of riveted, steel plate girder spans with timber decking. The decking is supported with steel cross-bracing. The edges of the Jane Brook are contained behind concrete embankments which extend for some distance on either side of the bridges. The spans are supported by two pairs of concrete pylons. The timber sleepers (decking) are covered with dirt (clay mixed with pea-gravel). The spans are approximately 2.5 metres wide and 50 metres long. Capped concrete piers are located on either side of the bridges at both ends. An oval disk has been welded onto the southern side of the southern span and bears the letters: W.A.G.R. (Western Australian Government Railways) across the top. In the centre are some illegible letters, beneath which is the inscription '1928 Midland Junction'. The deck of both spans is in good condition.

Figure 15. Bridge 1, October 2014

Bridge 2 spans the Jane Brook approximately 500 m further east, slightly to the north of where Mahogany Creek joins Jane Brook. This was the longest of the trestle bridges on the Deviation. The original wooden trestle bridge remains, but is entirely contained within a dirt embankment. Where the bridge crosses Jane Brook, three concrete culverts have been installed beneath the original bridge structure, before covering in earth to create the embankment. No evidence of the timber structure can be seen, but a small interpretive sign is located nearby. Its state of preservation with the embankment is unknown. The concrete culvert is in good condition.

Bridge 3 lies approximately 550 metres to the east of Bridge 2, while Bridge 4 lies approximately 200 metres beyond the third bridge. These bridges have similar construction to Bridge 1: a pair of steel plate riveted spans, with timber decking and steel cross bracing beneath the deck. The edge of the creek has been contained behind

a concrete embankment. Concrete piers, topped with concrete caps, are located on either side of the spans and at both ends. The state of these bridges in recent years has been relatively poor, with exposed and decaying decking, corrosion and encroachment by vegetation. However, the current refurbishment program noted above will restore and preserve the bridges.

Figure 16. Bridge 3 (or 4), October 2014

9. ASSESSMENT OF SIGNIFICANCE

Creative or Technical Achievement

The construction of the Eastern Railway Deviation was a major engineering project that saw vast amounts of rubble moved to construct embankments, together with intensive blasting and digging which created the first rail tunnel for Western Australia. All of this was achieved by using only picks and shovels, dynamite and horsepower.

The construction of the Swan View Tunnel is one of a major technical feat for the time. The precision with which both ends of the 330 m tunnel met during construction serves to illustrate the technical achievements of both the surveyors and engineers of the day who laboured under extreme difficulties.

Social Significance

The route of the Eastern Railway Deviation is highly valued by the local and wider community as a walking, cycling and bridle trail. The trail is intensively used for recreational purposes and provides important historical reminders of an era when the hills community was linked to Midland by rail.

It has important links to the community's sense of place as it assists in defining and linking the settlements that grew up along the railway route. The nuclei of these small settlements exist today, forming separate entities within the Shire of Mundaring (Hovea, Parkerville and Stoneville)

Rarity

Although comparable tunnels and bridges of this type are found elsewhere in the Country, the Swan View Tunnel is unique in Western Australia, being the only rail tunnel of its type ever built in the State.

Representativeness

The three steel bridges remaining on the Eastern Railway Deviation are representative examples of the type of steel bridge constructed by the Western Australian Government Railways department during the 1920s.

Integrity

Although the various elements which comprise Deviation are no longer used for rail transport, their current use as a walking trail has not compromised the original intent of either the tunnel or the bridges. The trail, tunnel and bridges serve as reminders of the once integrated rail line.

10. EMINENT PERSONS ASSOCIATED WITH THE PROJECT

Charles Yelverton O'Connor

C.Y. O'Connor (1843 –1902) was born in County Meath, Ireland and trained as an engineer under indentures to a Waterford railway engineer. In 1864 he emigrated to New Zealand where he worked initially as a surveyor in the North Island and then as an engineering surveyor for the Department of Works of Canterbury Province in the South Island, supervising the construction of roads, railways, harbours and water supply schemes. He was appointed District Engineer for the Province in 1872 and in 1883 Under-Secretary for Public Works in Wellington, the New Zealand capital.

In 1891 John Forrest, hearing that O'Connor was interested in a post outside New Zealand, offered him the position of Engineer-in-Chief of Western Australia which, after the exchange of several telegrams, O'Connor accepted.

While O'Connor is best known for his work on the Goldfields Water Supply, he also made important contributions to almost every aspect of the works undertaken by the Public Works Department in a period of unprecedented growth. The construction of Fremantle harbour was probably O'Connor's biggest personal triumph during his lifetime, as his proposal to build the harbour within the entrance to the Swan River was contrary to previous expert advice that this was impracticable.

While serving as Engineer-in-Chief, he also carried out the role of General Manager of Railways, making significant improvements to the State's rail network and turning the system from loss and inefficiency into expansion and success [14].

O'Connor took his own life on 10 March 1902 less than a year before Forrest turned on the water from Mundaring at Coolgardie and Kalgoorlie, and a year before completion of the Fremantle Harbour. His suicide is attributed to prolonged and extreme attacks on his personal character and professional expertise, as a result of anti-Forrest political machinations at the time.

O'Connor was a Member of the Institution of Civil Engineers and was appointed a CMG (Commander of St Michael and St George) in 1897.

(Photo: Web archive)

Sir John Forrest

John Forrest (1847-1918) was born in Bunbury, Western Australia. He trained as a surveyor and joined the staff of the Surveyor General's Office in 1865. In addition to his surveying work, during the next ten years he gained a widespread reputation as a capable and courageous explorer. In 1883 he was appointed Surveyor-General and Commissioner of Crown Lands and gained valuable administrative experience for seven years as an ex officio member of the Executive and Legislative Councils. When responsible government was granted to the colony by the British Government in 1890, he became the colony's first Premier and Treasurer, positions which he held without challenge for the ten years prior to the Federation of the Australian colonies to form the Commonwealth of Australia.

Forrest's policies as Premier were aimed at taking advantage of the mining boom to raise loans in London to finance the provision of public works for the colony. These were to be centred on Perth as the metropolis and allocated in a manner which balanced the needs of the metropolitan, agricultural, pastoral and mining regions, and which at the same time provided for the long term future of the colony, which Forrest saw in terms of expanded agricultural production.

Forrest was one of the first politicians to publicly promote an east-west trans-continental railway when, in 1888, he suggested that its construction should be one of the conditions required by Western Australia for joining an Australian Federation. For the next 25 years he seldom missed an appropriate opportunity to advocate construction of the railway.

At Federation, Forrest was elected to the House of Representatives as Member for Swan. He was prominent in the formation of the Liberal party (the Australian conservative party) and served as Treasurer in five ministries and was also Minister for Defence and Home Affairs. In this last capacity he introduced the unsuccessful Trans-Australian Railway Survey Bill in 1904. He supported the Bill when it was again introduced unsuccessfully in 1905 and 1906, and on its eventual successful passage in 1908. When the railway was completed in 1917, he rode on the first official train from Port Augusta to Kalgoorlie. He died in the following year while on the way to England to be installed as the first Australian-born baronet.

He was acting Prime Minister for three months in 1907 and was appointed KCMG (Knight Commander of St Michael and St George) in 1892 and GCMG (Grand Commander in the same order) in 1901.

(Photo: Web archive)

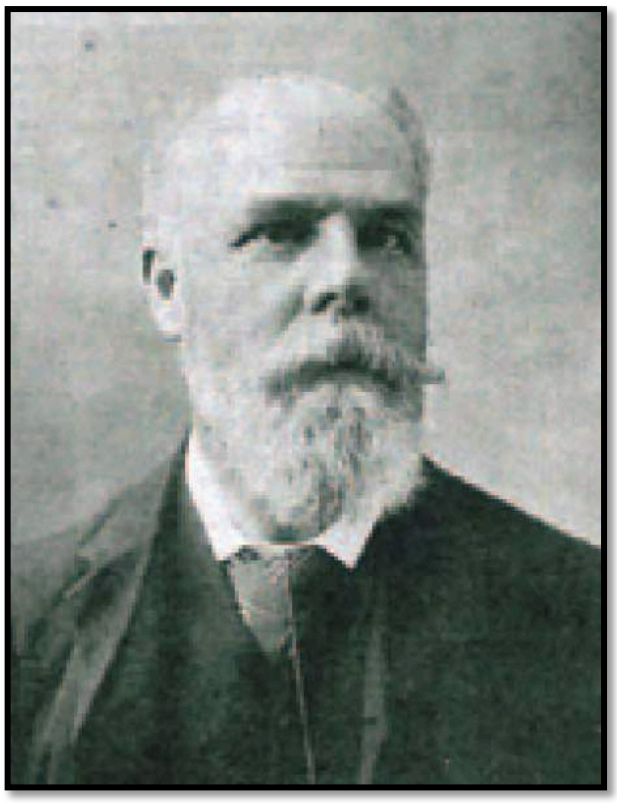
John Muir

John Muir was a railway engineer and licensed surveyor. He was born at Fiery Creek diggings, Ballarat, on 13 March 1857. He was educated at the Ballarat Grammar School and Scotch College, Ballarat. At the age of 16 he went to Melbourne and studied a further two years before joining the staff of the Engineer in Chief of Victoria at age 18. [4]

Within 15 years, Muir was acknowledged as an expert in railway location and construction. A young engineer who worked with Muir once commented that Muir had a 'great eye for grade and contour' [2]. Muir was seconded from Victorian Government service to Western Australia in October 1891, due to the economic depression there, in order to carry out surveys of alternative routes for the Eastern Railway up the Darling Range escarpment. His proposed route along the Jane Brook valley was adopted at that time, resulting in the Eastern Railway Deviation. In the 1960's, another of his surveyed routes to bypass the Range altogether, along the Swan/Avon river valley, was adopted as the route for the transcontinental standard gauge railway.

Muir continued service under O'Connor and Forrest as Inspector of Surveys, and played a major role in determining the route of the extension of the Eastern Railway from Kalgoorlie to South Australia. He carried out a 'flying survey' of the railway route from Kalgoorlie to the border. Muir with a party of nine men and sixteen camels left Kanowna, near Kalgoorlie, on 16 May 1901, and followed a diagonal route from Kanowna to Eucla. On the return trip, they followed approximately the eventual alignment of the railway, arriving back in Bulong on 19 August 1901, having covered over 1770 kilometres [2].

Edward Keane



Keane (1844-1904) was born in England in 1844 and trained as a civil engineer, helping to build railways before moving to South Australia where he continued that work before moving again in 1882 to Western Australia. In WA he built some 500 miles of track and became involved in surveying, building and timber milling through the family of his wife, Lilla. One of his "building" projects was the completion of St Georges Cathedral in Perth.

He won the tender for Stage 3 of the Eastern Railway (Chidlow's Well to York) in 1883. Extensions followed from York to Beverley, again built by Keane, completed in 1886. Other branch lines followed over the ensuing years to 1888. Keane was now well established as a leading railway contractor in Western Australia.

Keane was elected MLC for Geraldton in 1886 and was a member of the select

committee that inquired into the Saunders and Barratt proposal for Perth's first public water supply scheme (Victoria Dam). In 1889 he was elected MLC for Perth and bought a timber concession from Mason and Bird at Canning Mills. He also began negotiations with the Perth City Council on behalf of Neil McNeil and Co. to build the water supply scheme. He went on to manage the works until the end of 1890 when he was elected MLA for Geraldton and became a Perth City Councillor, being elected Mayor the following year.

Keane was involved in more railway construction and timber milling work in Perth, and invested in gold mining – financing prospecting parties and trading leases. In 1895 he became manager of the Midland Railway Co.

Following purchase by the new State Government of the Perth Water Supply scheme in 1896, Keane was made chairman of a board of management, but after one year the board was asked to resign following an investigation into its activities. Keane was declared insolvent amid questions of corruption, and pursued farming at his Grass Valley property. In May 1904 he won the Legislative Council seat of Eastern Province but died in July of that year before taking it up.

(Photo: Web archive)

11. INTERPRETATION PLAN AND BUDGET

Interpretation

It is proposed to install a 1200 x 600 glass-metal interpretation panel mounted together with the EH Marker disc on a free-standing stainless steel frame, similar in general design to the recently installed Ord River Diversion Dam panel (Fig. xx). The panel will be located adjacent to the heritage trail in John Forrest National Park. Details of the design of the structure and the artwork on the panel may need to be adapted to meet DPAW practices.

Figure 17. An example of the interpretation panel structure.

The most likely general location for the panel will be near the Visitor's Centre and Bridge 1, subject to DPAW requirements, which will maximise its exposure to the public. It can also serve to direct people towards the tunnel and the other bridges.

The content of the panel will tell the story of the deviation in brief form (adapted from this nomination), highlight the engineering challenges and the eminent people involved, and note the social and commercial impact of the deviation on the local and broader community.

Approximate Budget (based on costs for most recent project)

ITEM	NOTES	BUDGET
Nomination Production Costs	Volunteer effort	$0.00
Panel Artwork	Commercial prep for printing	$300
Panel/Frame Manufacture	Assisted by DPAW	$2800
Panel Delivery	Estimated	$150
Panel Install Costs	To be installed by DPAW	unknown
Ceremony organisation and costs	Assisted by DPAW	unknown
	TOTAL COST (known amounts):	$TBA

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Authors

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